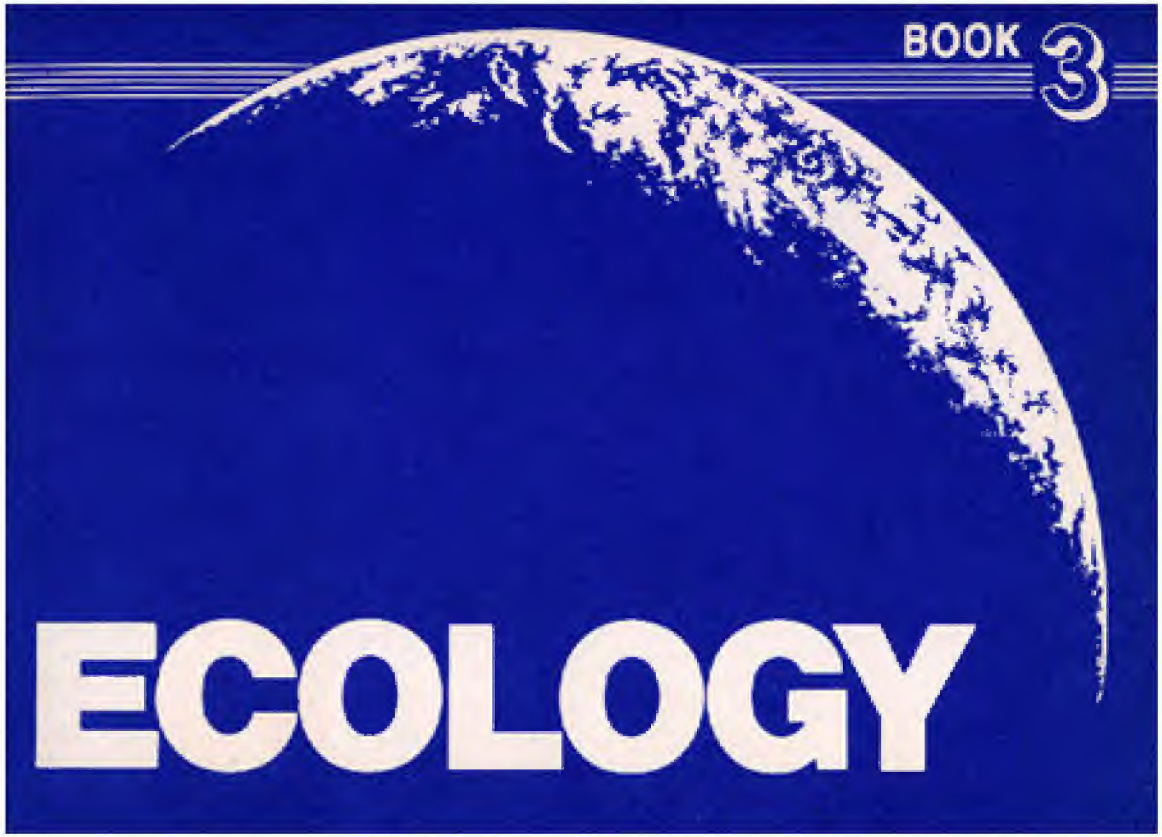

BOOK 3
ECOLOGY

Ultimately we are the endangered species. Homo sapiens is perceived to stand at the top of the pyramid of life, but the pinnacle is a precarious station.

— Patrick Leaky

ECOLOGY

There is something special about a spider's web. If you look carefully, you will see that all its threads are connected. Touch a thread — the whole web shakes. Try pulling even one thread out. The result is that the web changes its shape or breaks up altogether. Life on earth is rather like a spider's web. Can you think why?

Connections

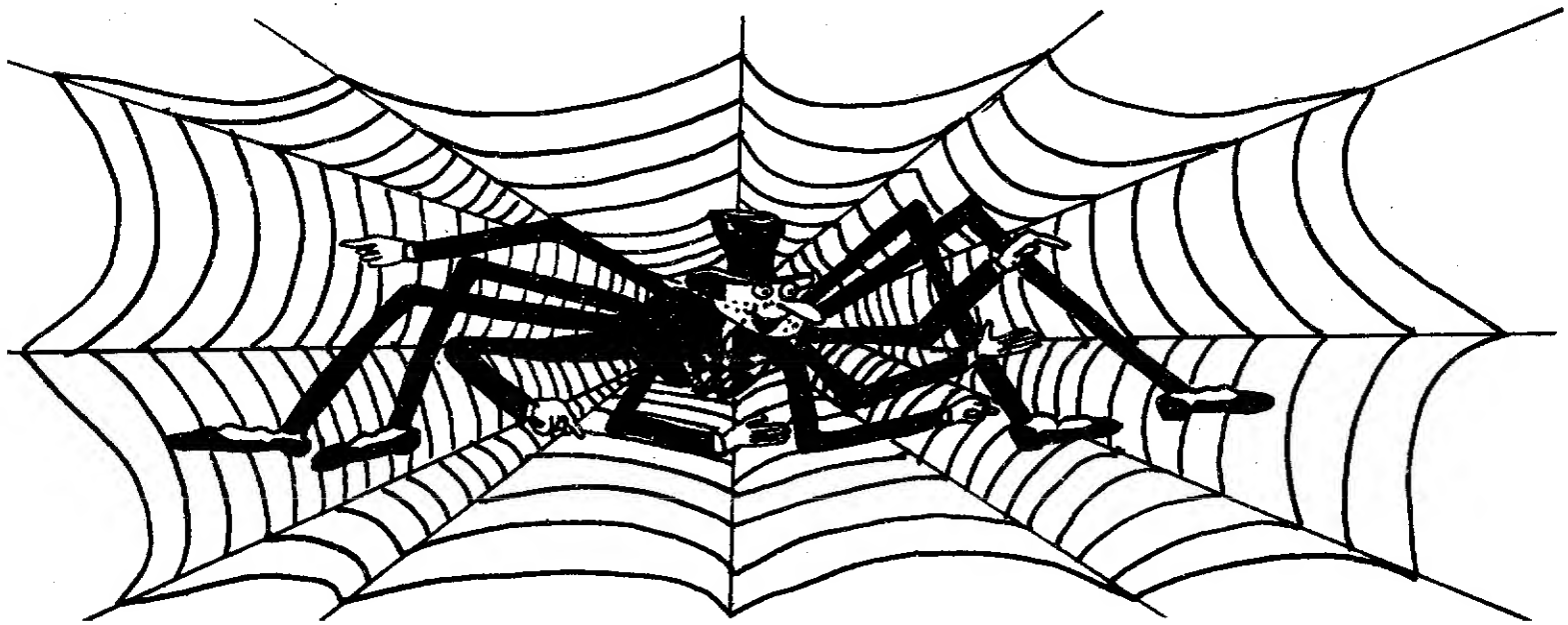
No plant or animal can get along all alone. All living beings need one another and non-living things like the sun, water, air and the earth itself. They are all connected like the threads in a spider's web. How are these connections made? How do they change, and why? The study of these questions is the subject matter of ecology. Ecology deals with the great house of Nature. It is the house in which all of us live.

The English word "ecology" is derived from an old Greek word "oikos", meaning house or home. "Oikos" is also the root of the English word "economy" We could say that ecology is conerned with the economy of Nature, an enormous house indeed.

Order

Nature's house is well-ordered. In some ways we can compare it to the organisation of a school. In a school every student has an individual roll rumber. A group of similar students form a section and a group of sections form a class, so sections 7A, 7B, 7C and 7D may form the class seven. All the classes together make up the school. The individuals are members of their section, class and school. Nature, of course, is not quite so simple. It is an immense organisation of a great variety of living beings.

In Nature, a group of individual plants or animals which can breed with one another to produce healthy, fertile off-spring, are called a *species*. Members of the same species living together in the same place form a *population*. The people who



live in a village or town are its human population. There may also be a population of cows, a population of dogs, of cats, of sparrows, of ants, of cockroaches,.and so on. Different kinds of populations living together from an *ecological community*. Think about the area in which you live. What are the populations living in it?

Interdependence

The members of an ecological community share the available space, air, water and food. They also depend upon one another in many ways : birds build their nests on trees, bees pollinate flowers, and so help the plant to multiply; micro organisms which live in a part of the stomach of a cow help the animal to digest its food. Just as the individuals in an ecological community depend upon one another, so too an entire ecological community depends upon other ecological communities. A group of interdependent communities, living side-by-side, is called an *ecosystem*. Individual -community - species - population - ecosystem : this orderly step-wise linkage is one of the threads in the web of life.

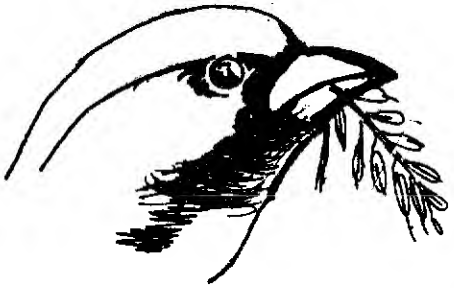
Ecosystems may be relatively small like a pond or field, or large like an ocean or mountain range. In some ways, the Earth itself behaves like one enormous, super-ecosystem made up of many, many inter-linked ecosystems, on the thin layer of the earth's surface which supports life. We call this super-ecosystem the *biosphere*.It extends down into the depths of the oceans and up into the atmosphere. Think about the town or city in which you live.Can it be called an ecosystem? Does it not depend on other ecosystems? For instance, where does the food that city people eat come from?

Adaptation

Every living being needs food, and usually finds a place to live near its food supply. (Human beings can now transport food over long distances and do not need to do this.) All organisms in nature are well-adapted to their own environment and food supply. For example, a sparrow which eats grain and seeds, has a very different kind of beak from a kingfisher which eats fish. Suitable adaptations help plants and animals "fit" into their environment, and reduce the competition for food.

Functions

Every living being in an ecological community has a particular function.Vultures which eat dead animals have a function. Crows, hyenas and worms have a function. Green plants have the most important function-*photosynthesis*. In the process of photosynthesis green plants make food out of non-living things : oxygen and sunshine. This food is stored in the plant's tissues and is what we all live on. Animals cannot make food in this way. Farmers grow food crops but they need living seeds to sow in the soil. The farmer takes care of the growing plant, but



it is the plant which makes the food, the grains of wheat, rice or millet.

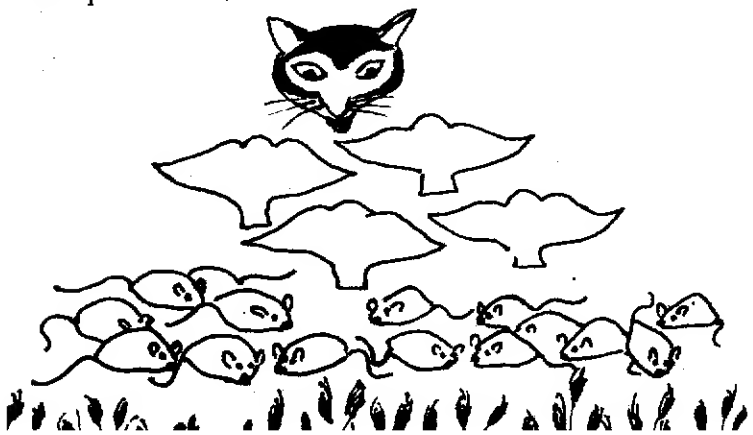
Food Webs

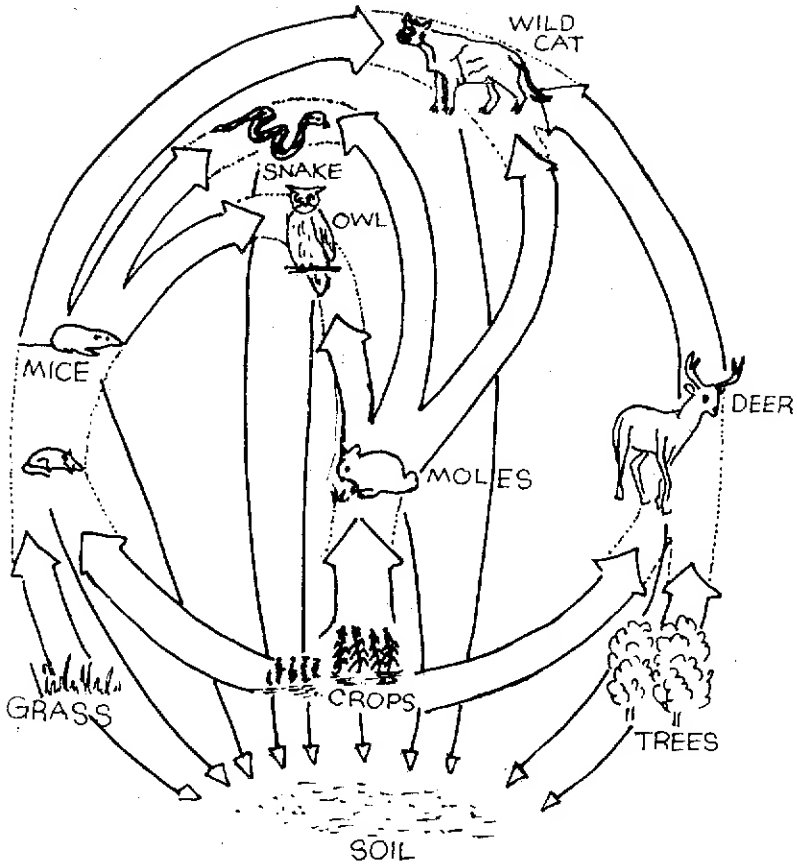
Some animals, the herbivores, get their food by eating plants; other animals, the *carnivores,* eat the plant-eating animals. *Omnivores,* such as human beings, eat both plants and animals. Green plants-herbivores-carnivores : this is another thread in the web of life. there may be two, three or even four animals in the thread, and because they are linked together by the food they eat, this is called a *food chain.*

A food chain does not have to be a straight line. It may be criss-crossed. In a pond, frogs eat the eggs of fish, and the fish eat the tadpoles, the young of frogs. The fish and the frogs depend upon each other for food. Such interpendence creates a balanced network of food chains, or a *food web.*

When animals die they are eaten by scavengers such as vultures and maggots (fly larvae). Dead animals and plants are decomposed by bacteria, fungi and other organisms to produce the substances that plants need for their own growth. The dead bodies of human beings too are de-composed and returned to the earth, either quickly by burning or over a period of time by burial.

Think about your place in the food chain. Are you part of a longer food chain when you drink a glass of milk, or when you eat a plate of rice?





Passing on energy

What is actually happening in a food chain is that the energy in the sun's rays is first captured by the green plants and then passed on, step-by-step. Only a small percentage of the solar (sun's) energy that falls on the earth is converted into plant tissues. At each stage the amount of energy that is passed on is less and less. That is why a forest of millions of green plants may support only a small population of herbivorous deer and only a very few carnivorous tigers. The populations in a food chain form a *pyramid.* The populations with the largest numbers are at the bottom, and those with the fewest are at the top.

Cycles

The non-living things in an ecosystem, the air, water and soil, are also part of its interconnecting threads. All plants and animals need certain elements, mainly carbon, oxygen, nitrogen and hydrogen, to build tissues and produce energy. Many other elements are also necessary such as calcium for bones and iron for blood.

Water (made up of oxygen and hydrogen) and the atmospheric gases (carbon dioxide, nitrogen and oxygen) are constantly moving in cycles through the ecosystem. For example, in the food chain, nitrogen is passed from one organism to another, and finanlly returns to the soil and the atmosphere. The nitrogen in the area is recaptured by leguminous plants like peas and pulses. (These plants are called leguminous because their seeds are in pods or legumes.) The leguminous plants have certain bacteria in the nodules of their roots, and these bacteria absorb atmospheric nitrogen. Some industrial proceses can also recapture atmospheric bacteria and convert it into ammonia and nitrates to be used as chemical fertilisers in the soil.

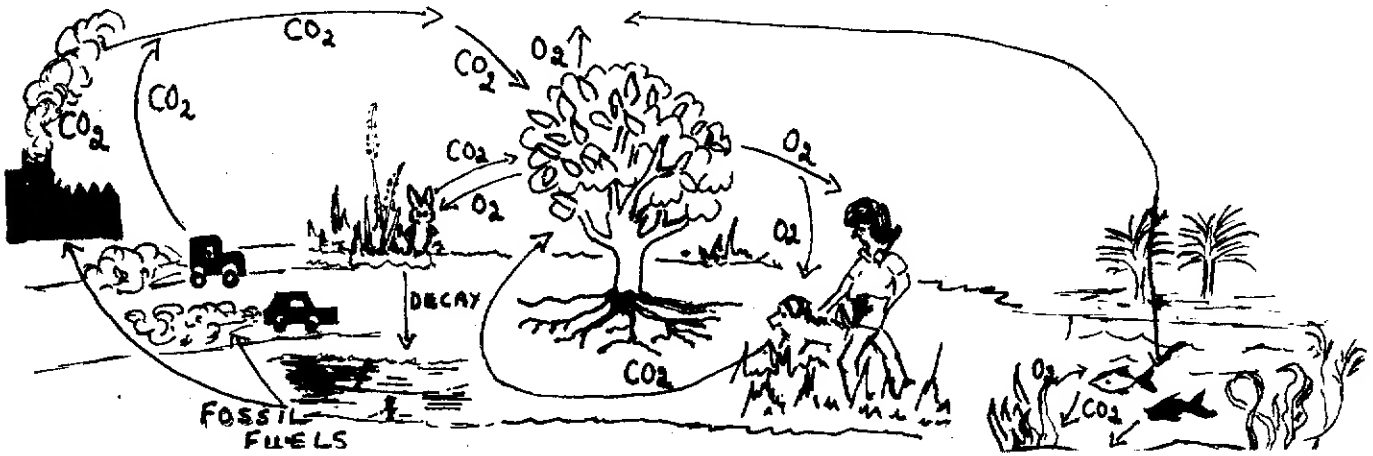
In the water cycle, the water on the earth's surface evaporates and enters the atmosphere, from where it comes back to the earth as snow, rain and hail. At the same time, in a slower process, the water from the earth's surface travels via the living beings of the ecosystems and returns to the atmosphere in the processes of respiration and transpiration.

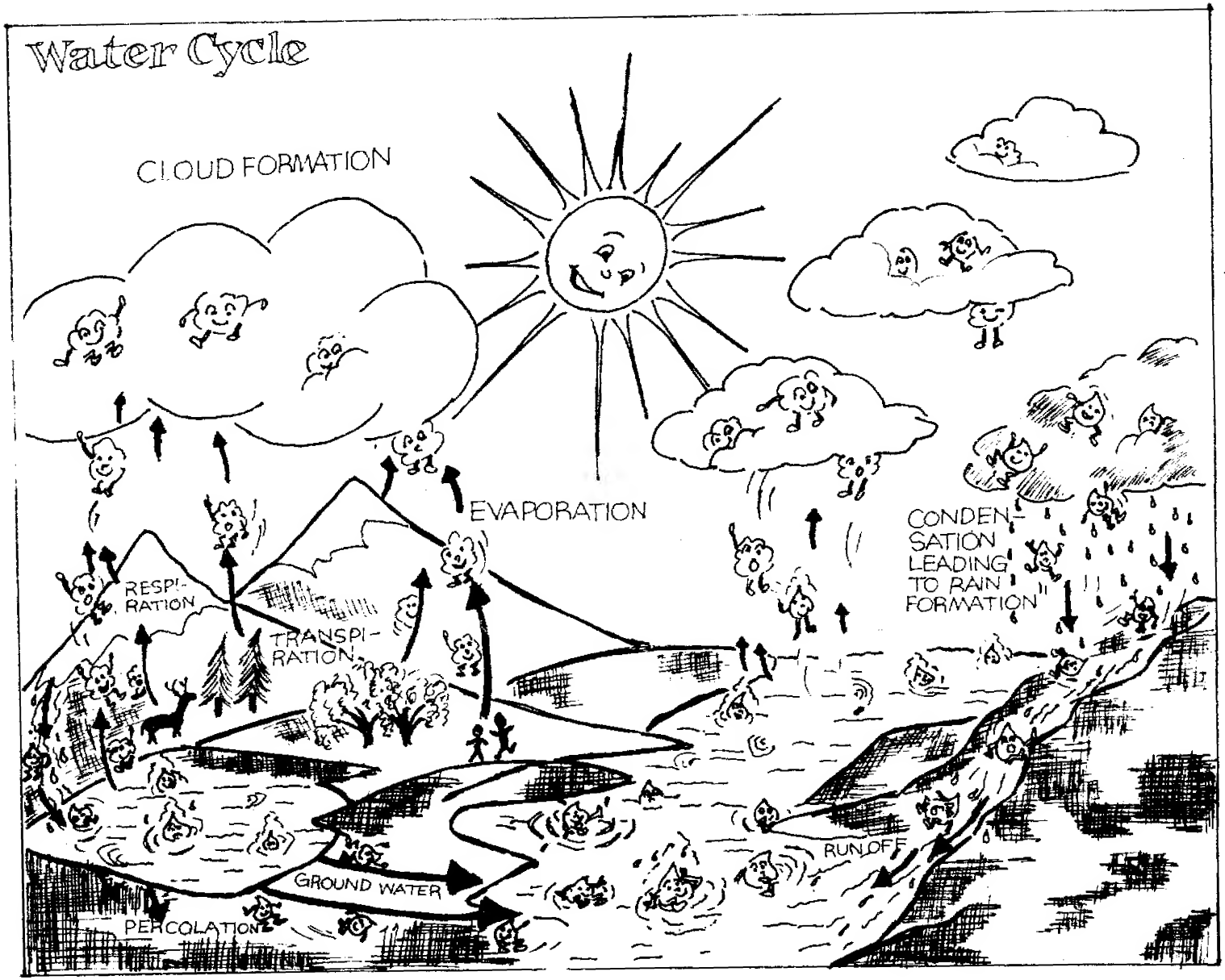
Consequences

An ecosystem is always changing, but gradually. The absorbtion of nitrogen by leguminous plants and the process of transpiration, for example, are not sudden changes. An ecosystem can cope with gradual changes. This is something like a spider's web which will tremble gently if you touch it lightly but steady itself once again. However, over the last 100 years of so, human beings have changed ecosystems very quickly and very drastically. Such change always has a consequence, because everything in an ecosystem is inter-linked

When an ecosystem changes gradually, the process of evolution continues undisturbed. But when there is sudden change, evolution is disrupted and the continuity of natural life is affected.

We humans have established vast plantations, built big dams, settled large cities. Such developments have destroyed some ecosystems and threatened others. That is why when we plan to change a natural ecosystem we have to ask ourselves whether such change is worthwhile and who will benefit from it.




Water Cycle
CLOUD FORMATION
EVAPORATION
RESPI-
RATION
TRANSPI-
RATION
CONDEN-
SATION
LEADING
TO RAIN
FORMATION
RUN OFF
GROUND WATER
PERCOLATION

Breaks in the web

When a farmer puts pesticides like DDT in his field to protect his crops from insect pests, the chemical in the pesticide kills the insects. But some of the chemical is absorbed by the plant When we eat the grain some of the pesticide accumulates in our bodies. A pesticide which kills insects may also be harmful for human beings. When something is added to a food chain it will not go away from the ecosystem, so when we put DDT in a field it becomes part of the food chain, and remains in the ecosystem. (See Booklet 9)

Sometimes, human beings try to break the links in a food chain in order to improve on nature's ways. Several years ago in China, it was felt that the birds were eating up the grain in the fields before they were ripe for harvest. If the birds were killed off, the grain would be safe, they hoped. A campaign to kill the birds was launched. But when thousands had been killed, the grasshoppers and other insects which the birds used to eat, multiplied. These insects attacked the grain. The consequence was that the crop suffered even more damage than from the birds.

This does not mean, of course, that we must just allow the insects or birds to damage grain meant for food. But we must understand how each ecosystem works and find ways of dealing with the problem without upsetting the ecosystem.

In earlier times humans did not have the tools to change the ecosystem drastically. Many forest-dwelling people, such as the tribals in some parts of India, even today, live more or less in harmony with the ecosystem of which they are a part. They have a subsistence economy — the ecosystem provides them with the bare minimum that they need to subsist or live, although it may produce no surplus.

Through the centuries, people's aspirations and needs have increased. They have developed more powerful tools so that they can use nature's resources to a much greater extent. Subsistence economies have been replaced by money economies in which consumers pay cash to get the things they want. Our needs extend to much more than just subsisting. For this we need more and more resources, for food, clothes, houses, transport, entertainment etc.

City people use resources that are taken out of distant ecosystems. For example, to build the large stadia for the Asian Games. which were held in New Delhi in 1982, trees were cut far away in the forests of Arunachal Pradesh, and the timber was transported to the Capital. When something is taken out of an ecosystem, the people who live nearby and the poorest among them are among the first to feel the impact. But eventually everyone is affected. Think about your daily activities. What are the things that you use, everyday, which come from a distant ecosystem?

Activity 1

An Octopus in the Pond

".... I would like to have a zoological garden at home. I would have horses, elephants, whales, a fish bowl, parrots and a lion. There would be an octopus in my swimming pool and a leopard could run freely in the large garden..."
"The home I would like to have" from Children's Opinions of the Human Environment, Environmental Council of Czechoslovakia.

Would you like a zoo in your home, like this Czechoslavakian child?
Do you think the octopus would be comfortable in a pond or pool ?
Or the leopard in the garden?
Imagine the home you would like to have. Describe or draw it.
Then compare your description/drawing with those of your friends.

Plant the mango, plant the tamarind and plantain:
Clusters of fruit will weigh their boughs.
Plant ten kachnar trees for flowers.
In a garden set the tulsi.
Water them unweariedly, but they will always wither.
But the trees in the forest which depend on God alone,
Never wither and die.
The forest trees grow always.

— A Gond folk song

Encourage creativity in children through fantasy. This makes learning fun and helps to develop new ideas. Use this activity as a starter. Repeat it after some months. Let children compare their own two descriptions/drawings.

Activity

The Tree Plays Host

THE PEEPAL tree is the host of the season this month. Tiny red figs of various shades are being served on its branches and all fruit-loving birds are queueing up from the early hours of dawn. The first batch of diners are the Green pigeons who, despite their fruit diet, have remained plump and jolly. They arrive in large numbers as soon as the sky lightens to gold and pink and the green leaves of the peepal flutter awake. In this strange light you can hardly make out where the leaves end and the green pigeon's ample body begins. But the "Hariyal" as the bird is called in Hindi likes its fruit dew fresh and always starts the day with peepal figs. A little later the Coppersmiths fly in and settle down on their favourite table.

The small Coppersmiths find this shelter of leaves extremely cosy and spend their days on the peepal even when it is not fruiting. Now that the tree offers both board and lodging, the Coppersmith could not ask for more. It hops on the fig-laden branches and once in a while peers out like a coy bride from beneath the leaves, its red "bindi" marked head glowing gaudily.

By lunch-time the Grey hornbill and his grey wife have also landed clumsily on the peepal. After a quick look around to see who else is there, the Hornbills begin to attack the fruit. They pick out the best figs with their large beaks and never move on till they have cleaned up the whole length of the branch. Some-times they bump into the Green barbet waddling down side-ways from the other end of the branch. The two ugly faces look at each other with horror and quickly turn around and in opposite directions. The Green barbet always takes longer to recover from this encounter and will keep calling out in its familiar two-note tremble before it calms down. As the day goes by other birds drop by and you may see more than 20 species of birds on the peepal.

Besides fruit-eating ones, there will be others like Bee-eaters and Golden-backed woodpeckers who chase the insects that hover over the sweet fruit, and the Spotted owlets dozing in the hidden depths of the peepal leaves. You might even see a lonely Vulture who has not been invited out for any scavenging, drowning its sorrow on peepal fruit juice.

-- Bulbul Sharma/Sunday Mail

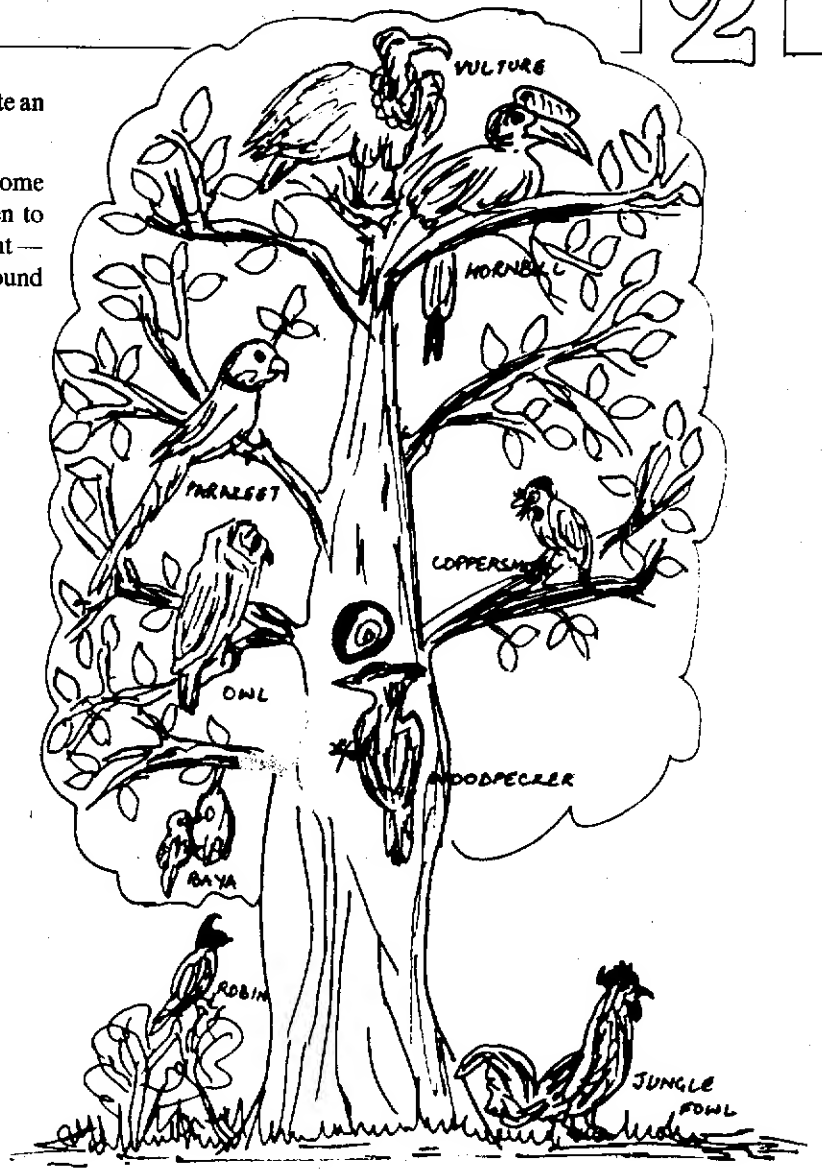
A single large tree can provide food and shelter to many different living creatures. Select a tree in your area, preferably a tree which is in flower, or bearing fruit, like the peepal tree in the passage. Observe it everyday for a week, and make a record of all the different insects, birds and small animals on, or under, the tree.

	Ant	Bee	Wasp	Myna	Crow
Day 1					
Day 2					
Day 3					
Day 4					
Day 5					

At the end of the week, use the information in your record to write an account of the community of animal life that the tree supports.

Instead of a tree, a corner of the school compound, a path with some greenery, or a small pond can be observed. Encourage children to make their observations quietly and not to disturb the environment — not to shake the branches of a tree, or move rocks and stones around to look at what is underneath.

Pigeon	Squirrel	Butterfly	and so on



Activity

Birds of a Family

Look at the beaks of the birds on the following page; decide where you would expect to find them, and what food each eats. Some of these birds are easy to spot. Look out for them. Make your own 'book' of common Indian birds with the help of the list.

	Bird	Habitat	Food
1.	Sunbird	Gardens and forests	Nectar, small flies and insects
2.	Egret	Marshes and jheels	Fish, frogs and insects
3.	Pelican	Inland jheels; coastal lagoons	Fish
4.	Spoonbill	Marshes and swamps	Small animals in shallow water
5.	Cottonteal	Tanks and jheels (the smallest duck in the world)	Water plants, worms covered by floating vegetation
6.	Vulture	Trees and buildings, in villages and towns	Dead rats, offal, garbage, human excreta
7.	Bush-quail	Dry grassland or jungle in the plains or foothills	Grain, grass seeds, shoots, insects
8.	Red-wattled lapwing	Open country and marshes	Insects, larvae, molluscs
9.	Kingfisher	On branches overlooking a ditch or pool	Fish
10.	Green bee-eater	Open countryside, forest clearings, grazing grounds, and near cultivated fields.	Dragon flies, bees and other winged insects in flight
11.	Hoopoe	Lawns, gardens and tree groves, in hills and plains	Insects, larvae and pupae, many of which are agricultural pests
12.	Weaver bird (baya)	Open cultivated areas	Seeds, cereals
13.	Barbet	Leafy tree tops	Fruits, especially figs of banyan and peepal
14.	Woodpecker	Thin forest, orchards, roadside trees	Ants and larvae
15.	Hornbill	Large trees in forests and cultivated areas	Mainly fruits, also lizards. mice and baby birds
16.	Common babbler	Dry, open scrubland, hedges	Spiders, grasshoppers and insects

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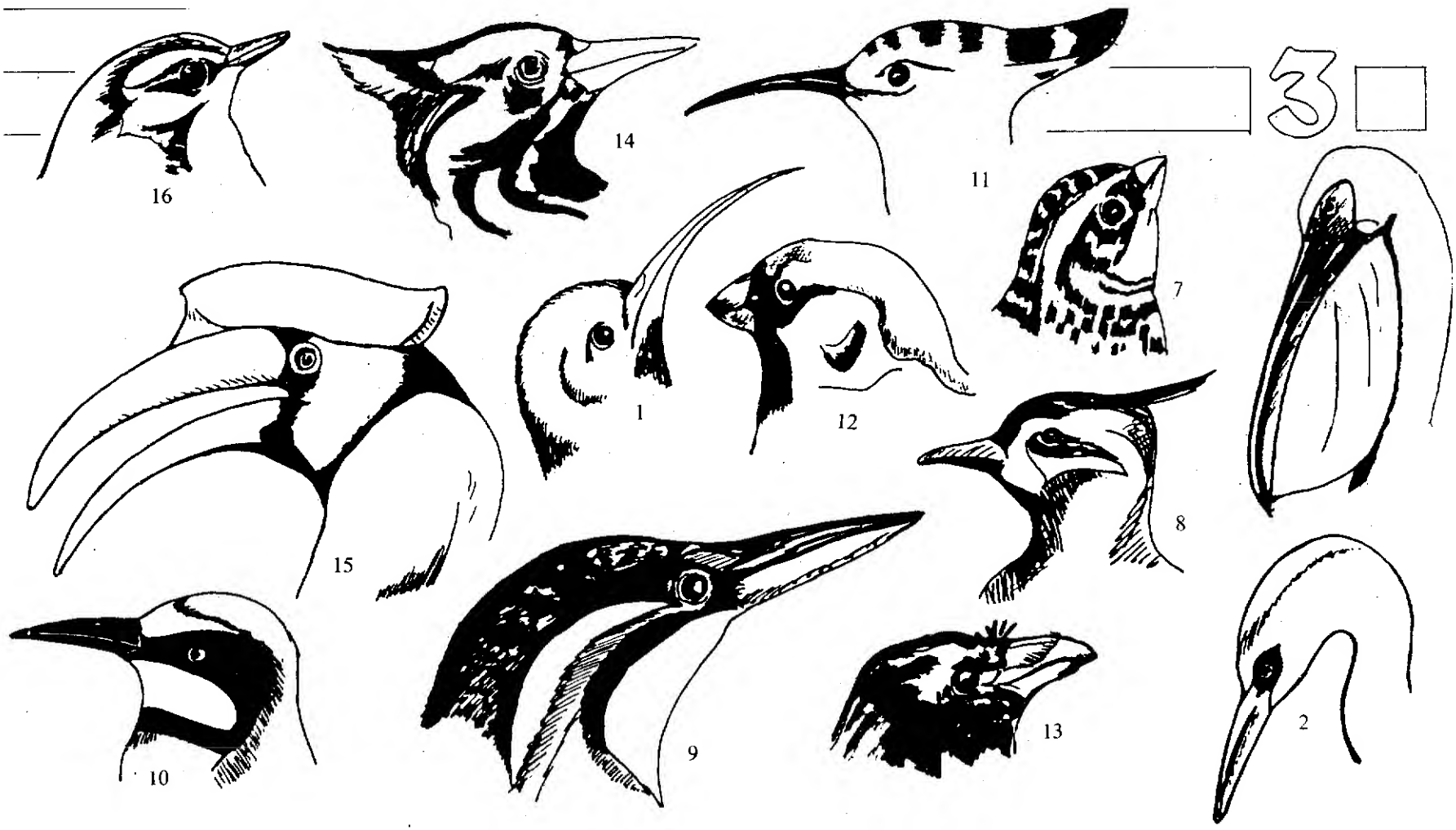


Bird "families" consist of species which are closely related to one another, and have similar habits and behaviour. Habits are reflected in the shape of the bird's wings and body, and in its movements. Beaks and claws reflect feeding habits. If you cannot identify a bird, it is often possible to identify the family by observing the beak. However, sometimes birds of different families may have deceptively similar beaks, like the hooked beaks of the hawk and the parakeet.

Read : *Collins Handguide to the Birds of the Indian Sub-Continent.*

Activity 4

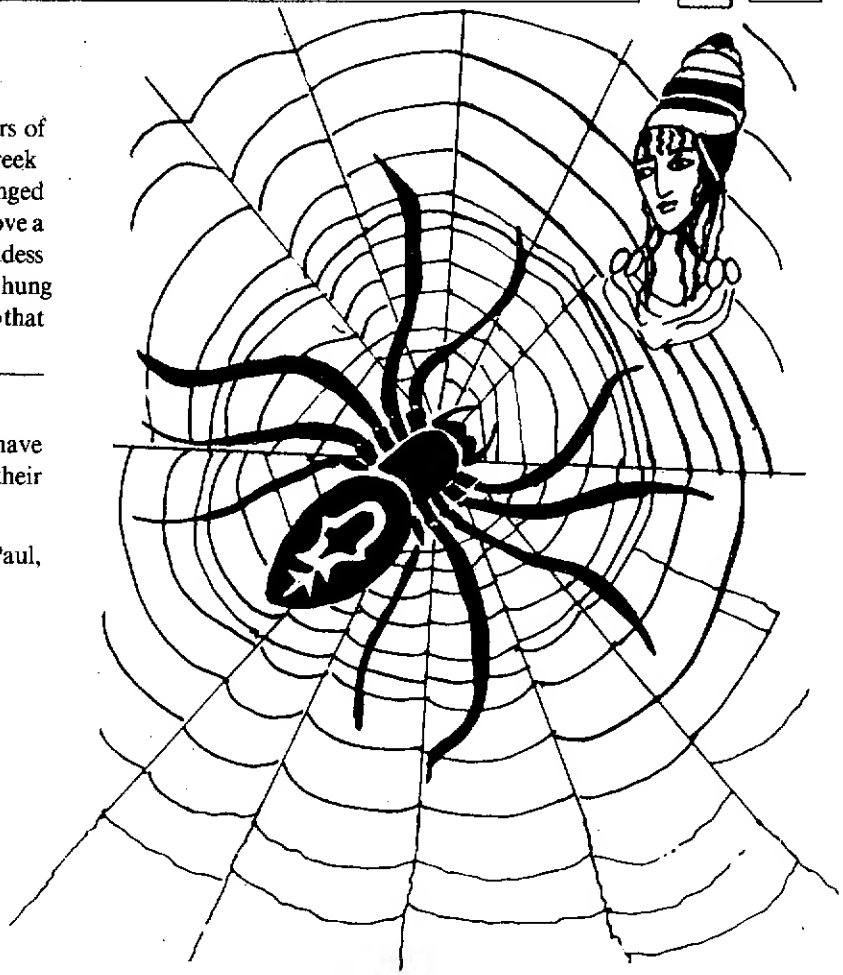
Spider!

Ticks, Scorpions and Spiders are *Arachnids;* they have four pairs of legs, unlike insects which have three. The word Arachne in Greek means spider. The legend is that a woman called Arachne challenged the Greek goddess Athene to a weaving competition. Arachne wove a tapestry more beautiful than the one made by Athene. The goddess was angry and tore up Arachne's work. Saddened by this, Arachne hung herself. But Athene repented and turned Arachne into a spider so that she could continue to weave beautiful spider's webs.

Write a skit based on this story

Spiders make better silk than silk worms. Then why don't we have spider farms where we can keep a lot of spiders together to get their silk?

For more information read : *The Story of the Spider* by John Paul, Ladybird Books — Natural History Series.



Ans : Spider silk is finer that of silk worms. But unlike silk worms spiders cannot be kept together in large numbers because they attack and-eat each other.

Activity 5

Let's Investigate

1. Why
   a) Birds feather overlap and point backwards
   b) The upper and lower jaw of a snake move separately
   c) Fish eyes are covered by a transparent skin
   d) The frog has a wet skin
   e) The grasshopper's ears are not in its head

2. How
   a) ticks b) scorpions c) spiders get their food

3. What special features about the mouth parts of these insects help them to get their food —
   a) ants b) bees c) houseflies

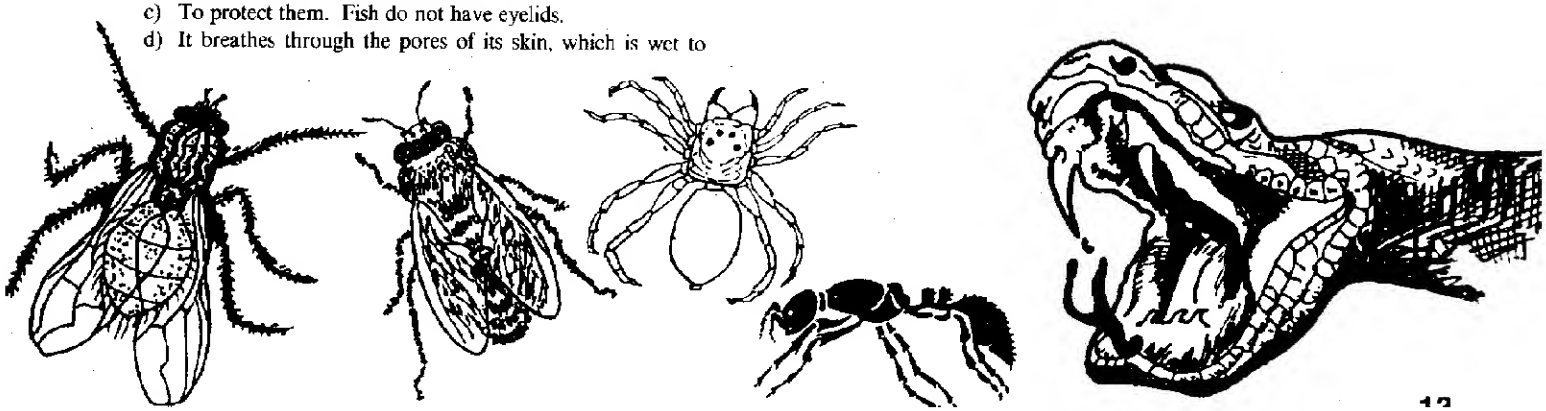
Answers

Notice that these are all useful adaptations for the animal

1. (a) So that they remain smooth and unruffled in flight
   b) Snakes do not chew their food; they have to open their mouths wide to swallow their prey whole.
   c) To protect them. Fish do not have eyelids.
   d) It breathes through the pores of its skin, which is wet to dissolve air.
   e) No insect has ears on its head. Most insects probably cannot hear at all. Grasshoppers and crickets can, with ears either on the legs or on the sides of the abdomen to pick up sounds in the ground quickly.

2. a) Ticks have sharp teeth to bite and use a probocis (tube) to suck the blood of cows, dogs and other animals.
   b) A scorpion holds its prey with large pincers, and brings its tail around to give its victim a paralysing sting.
   c) A spider cannot see an insect caught in its web. It can feel it through touch. The spider's mouth is too small to rip apart an insect, so it paralyses the insect and sucks the body juices out.

3. a) Ants scent their prey and tear it apart with their strong jaw-like mandibles. The wood ant alone sprays its victim with formic acid.
   b) Bees have short tube-like tongues (butterflies have long ones) to lick and suck.
   c) The housefly uses its mouth like a sponge.



Activity 6

A Place in the Web

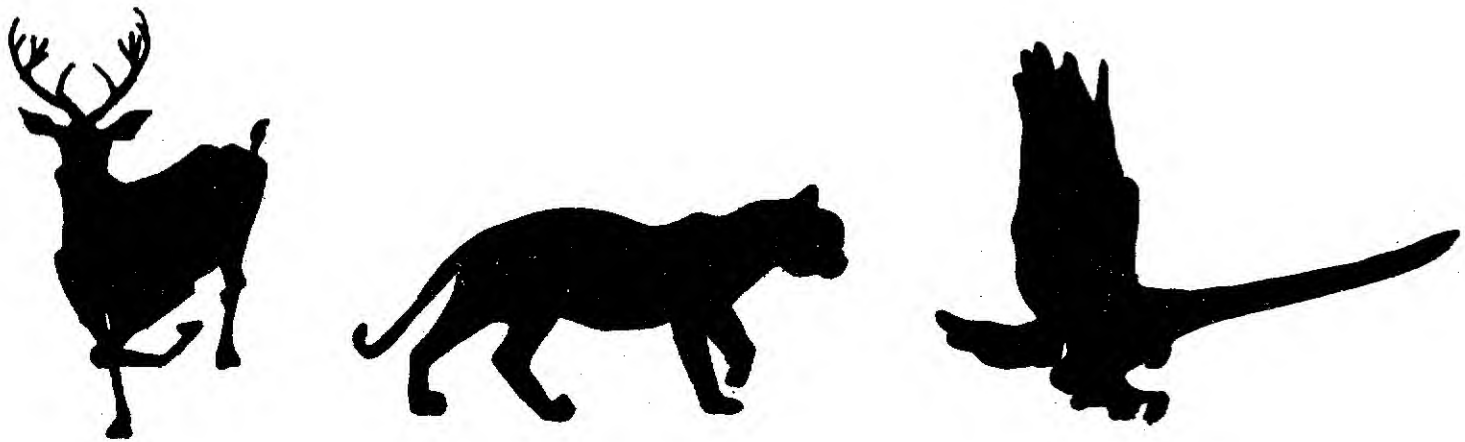
Nature has been generous to Ranthambhor and the park is criss-crossed with streams and rivulets flowing through great rock formations and steep scarps (slopes). The interior of the park abounds in wide grasslands as well as thick forest cover, and a vast variety of animals can thus avail of the habitat that suits them best...

The abundance of animal and plant life in Ranthambhor is well-meshed. The large population of sambars who prefer to eat shoots growing in the water of the lakes, rarely compete with chital who prefer the grass that grows on land. The dark also brings out the two big cats – the tiger and the leopard whose food habits differ considerably. The leopard being smaller, preys largely on langurs, small mammals, peacocks and other birds whereas the tiger selects large prey like sambar, chital and nilgai. Occasionally, the hunting range of the two may overlap, in which case the leopard will give way to the most powerful tiger.

— Fateh Singh Rathore/Sanctuary Magazine

One reason why different animals can live together in Ranthambhor is that they eat different things. What would happen if they all ate the same food?

With the help of the description, draw a food web. Think about the other living things that might be found there, and include these too — for instance, what does the langur eat, or the peacock?



Ranthambhor is a Wild Life Sanctuary in Rajasthan, known for it herds of sambar. Use the passage to discuss the concepts of sharing and competition for food.

Activity 7

Seed Puzzle

The summer that year turned out to be uncommonly hot and dry. The leaves on the trees began wilting earlier than usual, and the grass dried up. All it took was for one careless person to drop a smouldering match in the forest, and the fallen branches caught fire. Little tongues of flame spread in all directions from the match, licking the tree runks and enveloping them in a hot blaze. The most terrible thing that can happen in a forest began — a forest fire.

The fire raged for several days, and when it had ended, in the place of the forest was a smoking ash heap. Some charred tree trunks here and there were all that remained of the mighty forest.

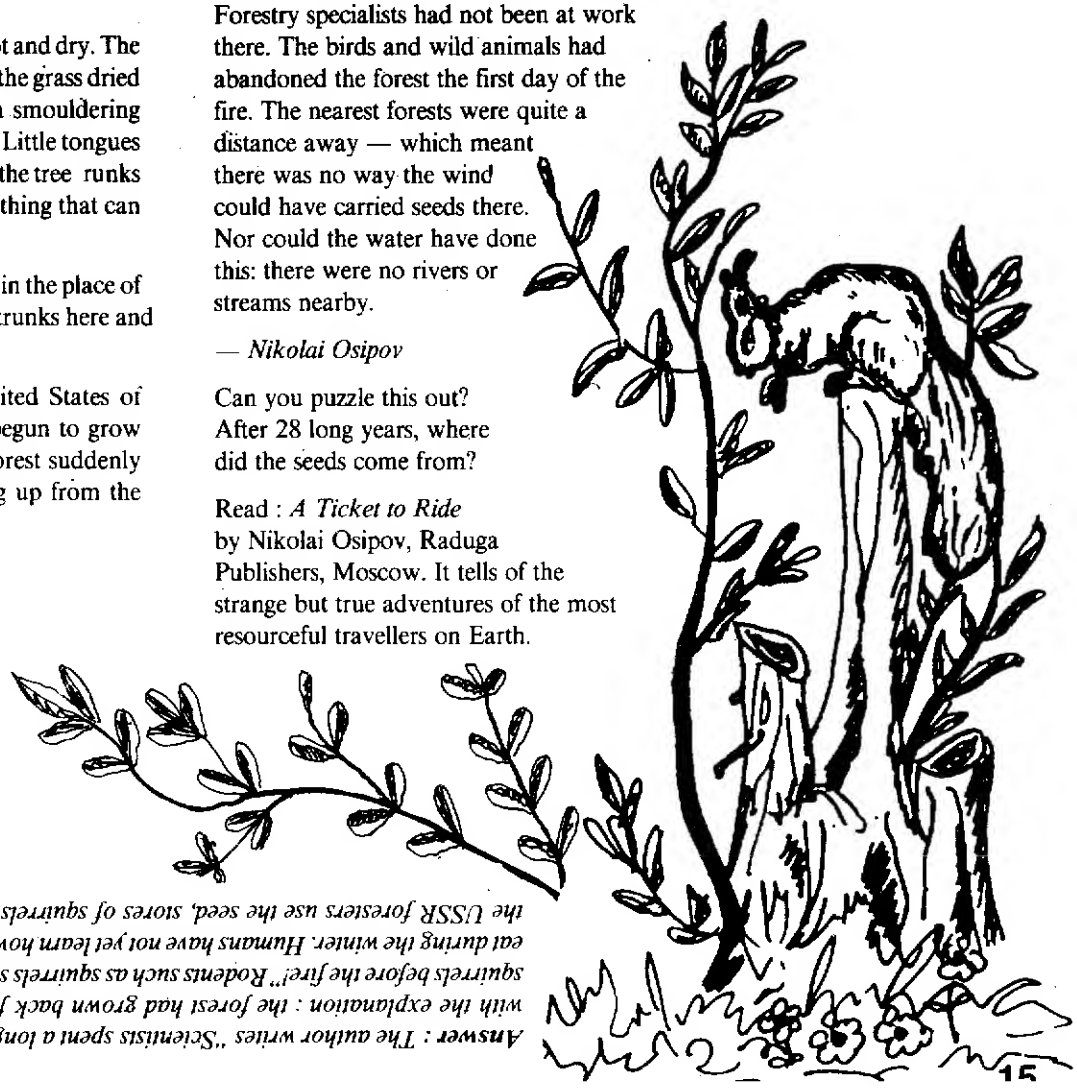
This occurred in 1891 in the northwest of the United States of America. A long time passed, but still nothing had begun to grow from the ashes. And then in the spring of 1919 the forest suddenly began to revive. Tender green shoots began to spring up from the charred earth.

Everyone was amazed : who had made these plantings? Forestry specialists had not been at work there. The birds and wild animals had abandoned the forest the first day of the fire. The nearest forests were quite a distance away — which meant there was no way the wind could have carried seeds there. Nor could the water have done this: there were no rivers or streams nearby.

— *Nikolai Osipov*

Can you puzzle this out? After 28 long years, where did the seeds come from?

Read : *A Ticket to Ride* by Nikolai Osipov, Raduga Publishers, Moscow. It tells of the strange but true adventures of the most resourceful travellers on Earth.



Answer : *The author writes "Scientists spent a long time puzzling over the problem. Finally they came up with the explanation : the forest had grown back from the seeds which had been hidden in the earth by squirrels before the fire!" Rodents such as squirrels select only goods quality seeds which they store away and eat during the winter. Humans have not yet learn how to select as efficienly as wild animals do. In the US and the USSR foresters use the seed, stores of squirrels and mice to make new plantations.*

Activity 8

Seed Dispersal

Some plants have to depend upon themselves to get around. You can find out how by playing a game with the seeds of a watermelon. Hold the end of the seed between your index finger and thumb. Squeeze hard. What happens?

Look out for the plants in your neighbourhood which shoot out their seeds from dry pods.

Find out how the plants in your neighbourhood spread their seeds, through animals, by water or wind.

SEED DISPERSAL

DISPERSAL AGENT

DISPERSAL MECHANISM	WIND	WIND	WIND
	WINGS — DRUMSTICK	WINGS — MAPLE	HAIR — COTTON
	WIND	WATER	WATER
	BASKET — PELICAN PLANT	FLOATS — CLEMATIS	BODY FLOATS — COCO NUT
	EXPLOSION	ANIMALS	ANIMALS
	CAMEL'S FOOT	BARBS — XANTHIUM	FRUIT — CHERRY

NAME OF PLANT _____

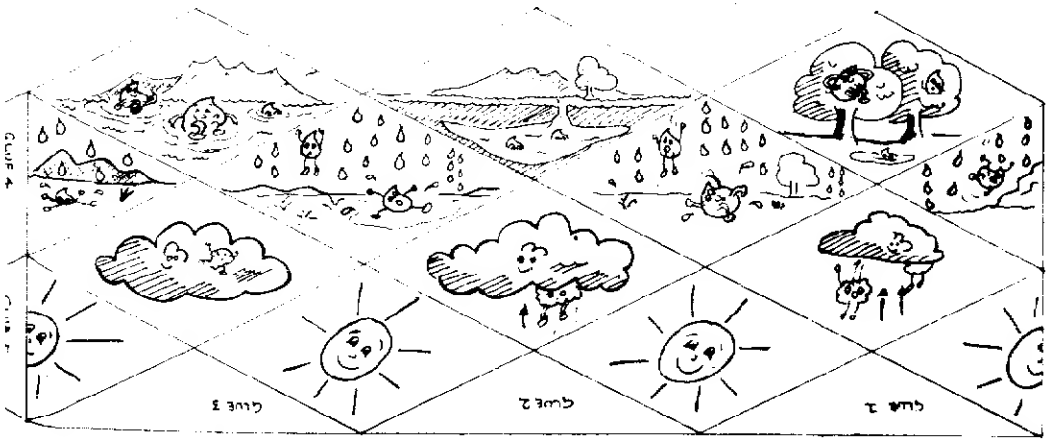
Activity 9

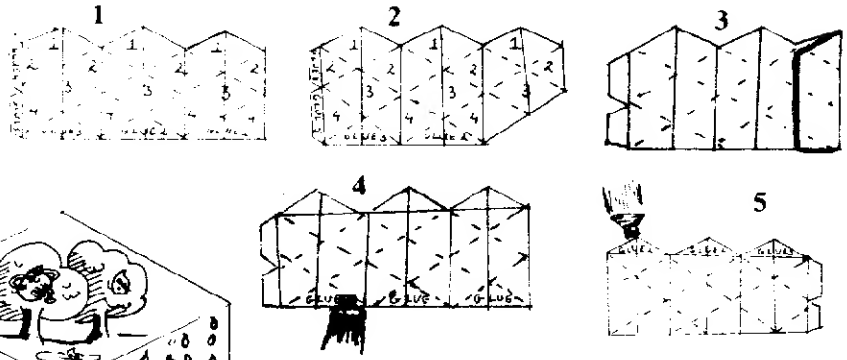
Make a Flexagon

The flexagon is an amazing model. Each time it flexes about its centre a different picture comes into view. It can be used to depict any four stage cycle or sequences. As you flex from one stage to the next, the link between one stage and the next becomes very clear.

Make a flexagon as follows :

1. Draw out the four stages as has been shown in Fig A. Make sure each stage is in a straight line.
2. Cut out the network precisely along the outline (Fig 1)
3. Fold all eight diagonal lines (marked with dashes) away from the picture (Fig 2)
4. Fold all vertical lines towards the picture (Fig 3)
5. First assemble the model without applying glue. When you see how it fits together in order of 1, 2, 3, 4, 5; Glue 1, 2, 3 on the picture side (Fig 4)
6. Apply glue to the three triangular hills on the plain side of the sheet (Fig 5). These have not been marked on the network.
7. Stick 'Glue 1' of picture side to 'Glue 1' of plan side. Do the same with 'Glue 2' and 'Glue 3' to get a chain (Fig 6)
8. Apply glue to flaps 4 and 5. They go inside the pocket to complete the bring (Fig 7). Your flexagon is now ready! (The use of a quick dry impact adhesive like Fevicol gives better results)





Activity 10

Mobile Garden and Hotel

Sloths are really, fantastic creatures. They are so beautifully adapted for their strange, topsy-turvy life in the tree-tops and, because they spend most of their lives upside down, and because their diet is highly indigestible leaves, their internal organs are unlike those of any other mammal. Their whole metabolism is as slow as their movements, as slow as bureaucracy. They may go for a week without urinating, for example.

The sloth's fur, of course, grows differently from that of other animals. In other mammals the hair grows from the backbone towards the ground, so the parting, so to speak, is on the backbone. In the sloth, it lies along the side of the belly and the rest of the hair grows towards the backbone, so when the sloth is upside-down the rain runs off the fall of the fur more easily. They have a very strange adaptation of their fur-thin layers of cells which lie diagonally across the hairs forming ridges in which two species of blue-green algae flourish. This gives the animal's fur a greenish tinge, which acts as a camouflage among the leaves, so the sloth is, in effect, a sort of hanging garden.
Even more curious than this, there are several species of beetle and mite which have taken up residence in the sloth's fur, as well as a strange species of moth called the snout moth.... The species has a curious relationship with the sloth. It lays its eggs on the sloth's fur and when these hatch out the larvae feed on the algae which exist in the grooves and possibly on the fur as well, so as well as being a sort of hanging garden the sloth is also a sort of permambulating furry hotel for all these insects.

— Gerald Durrell
(in How to Shoot on Amateur Naturalist)

SLOTH

The two-toed sloth is a mobile garden and hotel for other animal and plant species. Collect other examples of *Symbiosis,* the harmonious association of different beings. Make an illustrative chart or album.
Humans too could be called a "mobile hotel" — for micro-organisms.

Read : *The Whispering Land; The Drunken Forest* and other books by Gerald Durrell.

Activity 11

Everything is Interlinked

All the abiding influences of my life (I now realize) belong to my childhood. I was one of an extended family of about twenty children, several uncles and aunts, three grandparents who were then alive, sharing an ancestral home in a traditional, agricultural village in Kerala, South India

Those early years were earth-bound, shaped by love, a sense of godliness, respect for our elders and trust in our whole cycle of relationships. It was a complete environment, self-contained. We bathed in the river, ate off banana leaves, walked to school, climbed mango trees, played games with pieces of string and dice, and rang the temple bells. Grandmother healed our bruises with turmeric paste, cured an earache with a few drops of sesame (til) oil warmed with cloves and pepper.

This early education was considered the foundation of our "learning" We were allowed to learn, we were taught through the medium of things around us. There were no short cuts. A specific example of this is the way in which I learned to read and write.

My initiation into the alphabet was a huge village celebration. In the sand courtyard, rice was heaped, mixed with colourful petals. My hand was guided to draw the first letter. Everyone clapped, then we feasted. The next stage was learning to read the scriptures engraved on dried coconut leaves. After which I got my first slate, on which I could write and draw and learn simple sums. Naturally, I stumbled as most children do, made more mistakes than advances. But mistakes were easily wiped off with a damp cloth. Nobody laughed.

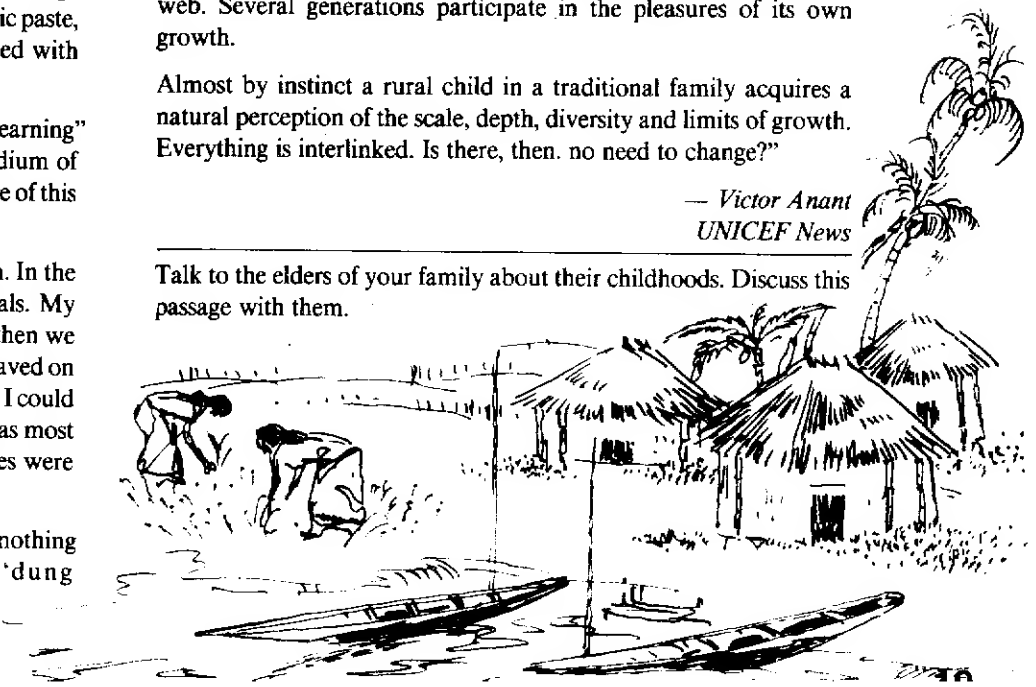
In the same way we were taught that everything had its use, nothing was wasted. Modernisers often refer to the "dung culture" of Indian villages. This dung, however, was not so much sacred as it was simply the cheapest and most easily available natural resource which had a variety of everyday uses. It was used to wash the floor — because it has the quality of a natural disinfectant. It was gathered as manure for our vegetables — direct evidence of what is now fashionably called "recycling". Dung was dried and used for fuel. The peasants used it to stop leaks in their thatched huts.

There are positive, and profoundly lasting lessons to be drawn from the first-hand experiences of four or five years of early childhood in a rural environment, slowly absorbing the rhythms and tempo of the world around us. A child becomes aware, gradually, of a whole community of shared experiences — not just an immediate family web. Several generations participate in the pleasures of its own growth.

Almost by instinct a rural child in a traditional family acquires a natural perception of the scale, depth, diversity and limits of growth. Everything is interlinked. Is there, then. no need to change?"

— Victor Anant
UNICEF News

Talk to the elders of your family about their childhoods. Discuss this passage with them.



Activity 12

Project Heritage

The range of latitude, altitude, climate and vegetation in India has given us an immense diversity of ecosystems. Some of these ecosystems are familiar to everyone; for instance, you can easily recognise the ecosystem depicted in this picture.

Here is a list of sites which represent different Indian ecosystems. These sites of outstanding natural beauty and ecological importance are part of our natural heritage. Using an atlas or a map of India locate these sites (or the districts). Notice that many of the ecosystems cross national or state boundaries.

The process of gathering information should be discussed, and children should be helped to identify how and where they can get information. They should be encouraged to find out for themselves, following a plan, sharing tasks, and pooling their information together.

Select any one ecosystem and make a group project on it, in the form of a chart, an album or a model. Collect information on the physical features, the climate, vegetation, animal life, and on the lifestyle and occupations of the people who live near or within each ecosystem.

Site	District	Ecosystem
1. Valley of Flowers	Chamoli, U.P.	Himalayan highlands, alpine vegetation and meadows
2. Namdapha	Tirap, Arunachal	Indo-Burmese rain forest
3. Rann of Kutch	Kutch, Gujarat	Salt marsh
4. Kanha (Satpura hills)	Mandla, M.P.	Meadows & mixed sal forest (dry deciduous)
5. Sundèrbans	24 Parganas, W Bengal	Coastal mangrove forest
6. Lake Chilka	Orissa	Tropical Lagoon
7. Manas	Kamrup, Assam	Sub-Himalayan river in forest (moist deciduous)
8. Nilgiri Hills (Western Ghats)	Nilgiri, Tamil Nadu/ Malappuram, Kerala/Gudalur, Karnataka	Malabar rain forest & mixed deciduous hill forest
9. Gulf of Mannar	off Tamil Nadu	Marine
10. Great Nicobar	Andaman & Nicobar	Island, Indo-Malayan rain forest

SUBJECT WISE KEY TO ACTIVITIES

ACTIVITY NUMBERS

S.NO.	BOOK	LANGUAGE	ART & CRAFT	SCIENCE	HISTORY	CIVICS	GEO-GRAPHY	MATHS	GAMES & QUIZ	SPECIAL PROJECTS
1.	ONE EARTH	1,4,6,7, 9,10,11	2,9,12	5,7,8,10			1,3,4,5		8	10
2.	ECOLOGY	1,4,6,7 10,11,12	1,9,10 12	1,2,3,4, 5,6,7,8, 9,10,11			12	9	3,5,8,9	12
3.	LAND & WATER	1,3,7,11 12	1,7a	3,4,5,6, 7,7a	5	3	2,4,5,6 8,9,10,11		2,10	12
4.	TREES & FORESTS	1,12	2,3,10	3,4,5,8 10	4,12	6,7,9,10	6,7	5	11	
5.	LIVING RESOUR-CES	1,6,7,8, 9,11,12	1,3,4, 10,11	2,3,5,7 9,10,12		11			5	12
6.	HOUSES & CITIES	1,2,4,9 10,12	2,5,10	6,7,2	1,4,9,10	3,5,8 10,11,12	1,9	3,8	12	11
8.	ENERGY	1,2,3,11	1,8,9	3,4,5,6 10,11		2		4	4	11,12
9.	POLLUTION	1,2,3,5 6,8,10,11	2,5,7	5,6,8,9 10,11,12		3,5,6	4	9	8,12	